Abstract: Mechanistic effects models are gaining interest in the scientific community and in regulatory settings. These models have the potential to facilitate species extrapolation, thereby decreasing the need for toxicity testing for risk assessment. They also provide an opportunity to quantify the complexities of multiple interacting stressors on environmental scenarios. Dynamic energy budget (DEB) theory represents a unifying framework for assessing the mechanisms that drive toxicant effects on life history traits. We report here on the progress of two case studies for an example chemical tested on two species of Cladocerans, Ceriodaphnia dubia and Daphnia magna. Over 70% of the ingredients in home and personal care products are considered baseline toxicants. We use phenol as a model baseline toxicant. A dynamic energy budget model was calibrated for each species, and differences in parameters and physiological mode of action are discussed. This work also explores how DEB based modelling can incorporate environmental factors such as food availability and temperature into risk assessment. In conclusion, the present study demonstrates the potential utility of DEB based models for species extrapolation and chemical risk assessment in an AOP framework.